DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed 9/16/2011 have been fully considered but they are not persuasive. Examiner respectfully disagrees with applicant's arguments pg. 12. Applicant does not give the claim language the broadest most reasonable interpretation. Firstly applicant's "frame" is not limited to a time domain interpretation. Secondly a "sample" is not restricted to the output signal Y (k) of Feng. Feng clearly discloses sample of the input signal (Fig. 7 col. 5 line 61-67 col. 6 line 1-12 lines 30-34). Feng as applied reads on applicant's claim language.

2. Examiner respectfully disagrees with applicant's arguments pg. 13. Feng does not teach away from applicant's claim language. Applicant's cited portion of Feng simply discloses that an operator can stop the signal processing of Fig.7, this does not teach away from the claim language's "frame".

3. Examiner's official notice is proper. See 2144.03 A-C. Examiner's official notice is based on the fact that smoothing is a well-known technique in the art. Applicant does not address the issue of knowledge in the art which is necessary to challenge an official notice statement. see MPEP 2144.03 C. Applicant states,"... smoothing an audio signal may or may not be well known in the art..."

4. To further support Examiner's conclusion Laroche (6405163) clearly discloses smoothing weights as presented in the office action below.

5. With regards to the patentability of claim 1, each element of applicant's claim 1 is well known in the art at the time of the invention as evidenced by Examiner's applied art. A particular arrangement of well-known elements or processes is not considered novel if the results of the combination are predictable and if in combination each element merely performs the same function as it does separately. See MPEP 2143A.

6. Laroche (6405163) is the only newly cited reference.

Claim Rejections - 35 USC § 101

1. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claim 32 the claimed invention is directed to non-statutory subject matter. Claim 32, "A computer program stored in a computer-readable storage medium, said computer program…" is non-statutory subject matter. "a computer-readable storage medium" is non-statutory because one of ordinary skill in the art could interpret "a computer-readable storage medium" to include transitory media, like wireless signal, internet networks, all of which are non-statutory.

Allowable Subject Matter

1. Claims 4, 8-10, 12, 22-25, allowed.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 6, 13-15, 17-20, 28-30, 32-33 rejected under 35 U.S.C. 103(a) as being unpatentable over Bradley (5463694) in view of Feng et al (7076072) in further view of Laroche (6405163).

Claim 1, Bradley discloses a method executed by a processor for producing a combined directional signal (Fig. 1-2), the method comprising: deriving from two omni-directional microphones a first signal having an omni-directional polar pattern (Fig. 2 signal 223); and deriving from the two omni-directional microphones a second signal having a bi-directional polar pattern (Fig. 2 signal 221), and constructing the combined directional signal from a weighted sum of a first signal weight of the first signal and a second signal weight of the second signal (Fig. 2 and col. 5 line 24-46 and line 65-67 and col. 6 line 1-4),

Bradley does not explicitly disclose deriving from one of two omni-directional microphones the first signal having an omni-directional polar pattern. However Bradley discloses deriving from the average of two omni-directional microphones the first signal having an omni-directional polar pattern (Fig. 2 col. 5 line 57-59). It would have been obvious to one of ordinary skill in the art at the time of the invention to try a single omni-directional mic or an average of a number of omni-directional mics in order to provide an omni-directional signal with reduced artifacts or in order to fit size restrictions of an audio device.

Bradley does not explicitly disclose a method for producing a combined adaptive directional signal wherein the first signal weight and the second signal weights are calculated in a non-iterative manner by taking the first signal and the second signal as

inputs, and determining from the first and second signals the first and second signal weights by mathematically calculating the first and second signal weights in a manner to comply with predefined constraints that: (i) the weighted sum is to give the combined adaptive directional signal a constant gain in a predetermined direction, by imposing a constraint that the first signal weight and the second signal weight add to a predetermined value and (ii) power of the combined adaptive directional signal is substantially minimized by ensuring that the derivative with respect to signal weight of the energy of the output signal is zero. However Bradley discloses weights for the first and second signals (Fig. 2).

Feng discloses a method for producing a combined adaptive directional signal wherein the first signal weight and the second signal weights are calculated in a

non-iterative manner by an optimizer (Fig. 1 col. 6 line 10-55), the optimiser taking the first signal and the second signal as
inputs, and the optimiser determining from the first and second signals the first and second signal weights by mathematically calculating the first and second signal weights in a manner to comply with predefined constraints that: (i) the weighted sum is to give the combined adaptive directional signal a constant gain in a predetermined direction, by imposing a constraint that the first signal weight and the second signal weight add to a predetermined value (Fig. 1 and col. 6 line 15-35)and (ii) power of the combined adaptive directional signal is substantially minimized by ensuring that the derivative with respect to signal weight of the energy of the output signal is zero (abstract col. 6 line 45-65) and wherein the first signal weight and the second signal weight are calculated for a series of frames each frame having a predetermined length including first signal samples and second signal samples (Fig. 7 col. 5 line 61-67 col. 6 line 1-12 line 30-34) Furthermore Feng discloses the first and second signal can be derived from microphones of various directivity including omni-directional and bi-directional (col. 18 line 30-37).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the microphone configuration of Bradley with the adaptive summing process of Feng in order to better suppress interference in input audio signals.

Bradley in view of Feng does not explicitly disclose wherein the first signal weight and the second signal weight are smoothed to minimize frame-to-frame variation in the calculated weights.

Laroche discloses an audio processing system that generates channel weights and the weight are smoothed to minimize frame-to-frame variation in the calculated weights (Fig. 1 col. 4 line 65-67 col. 5 lines 1-10).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the beamformer of Bradley in view of Feng with a smoother for the weights in order to avoid erratic variations as taught by Laroch (col. 5 line 1-2).

Claim 6 analyzed with respect to claim 1, 5 Bradley in view of Feng do not explicitly disclose wherein N=64. However it would have been obvious to one of ordinary skill in the art at the time of the invention that design incentive would determine the number of samples in order to provide a designer with a desired degree of fidelity or meet computational power limitations.

Claim 13 analyzed with respect to claim 1, Bradley in view of Feng disclose wherein the omni-directional microphones comprise a front microphone and a

rear microphone, and said predetermined direction is the forward direction along the microphone axis (Bradley Fig. 2, 5).

Claim 14 analyzed with respect to claim 1, 13 Bradley in view of Feng disclose wherein the second signal is provided by the difference between signals produced by the front and rear microphones, without the use of a delay element (Bradley Fig. 2 signals 109 & 111).

Claim 15 analyzed with respect to claim 13-14, 1, Bradley in view of Feng disclose further comprising processing the second signal by means of an integrator element or an integrator-like filter before constructing the combined signal, thereby compensating for the attenuation of low frequencies and phase shifts introduced in the subtraction of the two omni-directional signals (Bradley Fig. 2 .element 217).

Claim 17 analyzed with respect to claim 1 Feng discloses wherein said first and second signals are frequency domain samples (Fig. 7 and col. 5 line 60-67 and col. 6 line 1-13).

Claim 18 analyzed with respect to claim 17, 1, Feng discloses further comprising calculating and applying the weights to several independent subsets of frequency domain samples, to give different directional responses at different frequencies

and/or to allow selective suppression of different frequencies (col. 6 line 41-60 and col. 8 line 21-27).

Claim 19 analyzed with respect to claim 1, Feng discloses comprising applying a frequency weighting function to said first and second signal before calculating said signal weights (col. 6 line 14-65).

Claim 20, Bradley discloses an apparatus for producing a combined directional signal, (Fig. 1-2) the apparatus comprising: producing from two omni-directional microphones a first signal having an omni-directional polar pattern (Fig. 2 signal 223); a differencing element for deriving from the two omni-directional microphones a second signal having a bi-directional polar pattern (Fig. 2 signal 221); a summation device for constructing the directional signal from a weighted sum of a first signal weight of the first signal and a second signal weight of the second signal (Fig. 2 and col. 5 line 24-46 and line 65-67 and col. 6 line 1-4), Bradley does not explicitly disclose deriving from one of two omni-directional microphones the first signal having an omni-directional polar pattern. However Bradley discloses deriving from the average of two omni-directional microphones the first signal having an omni-directional polar pattern (Fig. 2 col. 5 line 57-59). It would have been obvious to one of ordinary skill in the art at the time of the invention to try a single omni-directional mic or an average of a number of omni-

directional mics in order to provide an omni-directional signal with reduced artifacts or in order to fit size restrictions of an audio device.

Bradley does not explicitly discloses an analog-to-digital converter for producing the microphone signals and an optimiser for calculating the first signal weight and the second signal weight in a non-iterative manner, the optimiser taking the first signal and the second signal as inputs, and the optimiser determining from the first and second signals the first and second signal weights by mathematically calculating the first and second signal weights in a manner to comply with predefined constraints that: (i) the weighted sum is to give the combined adaptive directional signal a constant gain in a predetermined direction, by imposing a constraint that the first signal weight and the second signal weight add to a predetermined value and (ii) power of the combined adaptive directional signal is substantially minimized by ensuring that the derivative with respect to signal weight of the energy of the output signal is zero.

Feng discloses an analog-to-digital converter for producing the microphone signals (Fig. 1, 6) and an optimiser for calculating the first signal weight and the second signal weight in a non-iterative manner, the optimiser taking the first signal and the second signal as inputs, and the optimiser determining from the first and second signals the first and second signal weights by mathematically calculating the first and second signal weights (Fig. 1 col. 6 line 10-55), in a manner to comply with predefined constraints that: (i) the weighted sum is to give the combined adaptive directional signal a constant gain in a predetermined direction, by imposing a constraint that the first signal weight and the second

signal weight add to a predetermined value and (ii) power of the combined adaptive directional signal is substantially minimized by ensuring that the derivative with respect to signal weight of the energy of the output signal is zero (abstract col. 6 line 15-65) wherein the first signal weight and the second signal weight are calculated for a series of frames each frame having a predetermined length including first signal samples and second signal samples(Fig. 7 col. 5 line 61-67 col. 6 line 1-12 line 30-34)Furthermore Feng discloses the first and second signal can be derived from microphones of various directivity including omni-directional and bi-directional (col. 18 line 30-37).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the microphone configuration of Bradley with the adaptive summing process of Feng in order to better suppress interference in input audio signals.

Bradley in view of Feng does not explicitly disclose a filter for filtering or smoothing the first signal weight and the second signal to minimize frame-to-frame variation in the calculated weights.

Laroche discloses an audio processing system that generates channel weights a filter for filtering or smoothing the first signal weight and the second signal to minimize frame-to-frame variation in the calculated weights. (Fig. 1 col. 4 line 65-67 col. 5 lines 1-10).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the beamformer of Bradley in view of Feng with a smoother

for the weights in order to avoid erratic variations as taught by Laroch (col. 5 line 1-2).

Claim 28 analyzed with respect to claim 20 recite the limitations of claim 13.
Claim 29 analyzed with respect to claim 20, recite the limitations of claim 14.
Claim 30 analyzed with respect to claim 20, 28 see claim 15

Claim 32, Bradley discloses a computer program stored in a computer-readable storage medium, said computer program, when executed by a computer, performing the steps (Fig. 1, 5) of: deriving from two omni-directional microphones a first signal having an omni-directional polar pattern (Fig. 2 signal 223); deriving from the two omni-directional microphones a second signal having a bi-directional polar pattern (Fig. 2 signal 221); and constructing the combined directional signal from a weighted sum of a first signal weight of the first signal and a second signal weight of the second signal (Fig. 2 and col. 5 line 24-46 and line 65-67 and col. 6 line 1-4),

Bradley does not explicitly disclose deriving from one of two omni-directional microphones the first signal having an omni-directional polar pattern. However Bradley discloses deriving from the average of two omni-directional microphones the first signal having an omni-directional polar pattern (Fig. 2 col. 5 line 57-59). It

would have been obvious to one of ordinary skill in the art at the time of the invention to try a single omni-directional mic or an average of a number of omni-directional mics in order to provide an omni-directional signal with reduced artifacts or in order to fit size restrictions of an audio device.

Bradley does not explicitly disclose wherein the first signal weight and the second signal weights are calculated in a non-iterative manner by an optimiser, the optimiser taking the first signal and the second signal as inputs, and the optimiser determining from the first and second signals the first and second signal weights by mathematically calculating the first and second signal weights in a manner to comply with predetermined constraints that: (i) the weighted sum is to give the combined adaptive

directional signal a constant gain in a predetermined direction, by imposing a constraint that the first signal weight and the second signal weight add to a predetermined value and (ii) power of the combined adaptive directional signal is substantially minimized by

ensuring that the derivative with respect to signal weight of the energy of the output signal is zero.

Feng discloses a computer program stored in a computer-readable storage medium, said computer program, when executed by a computer, performing the steps wherein the first signal weight and the second signal weights are calculated in a non-iterative manner by an taking the first signal and the second signal as inputs, and the determining from the first and second signals the first and second signal weights by mathematically calculating the first and second signal weights

in a manner to comply with predetermined constraints (Fig. 7 abstract col. 6 line 15-65) that: (i) the weighted sum is to give the combined adaptive directional signal a constant gain in a predetermined direction, by imposing a constraint that the first signal weight and the second signal weight add to a predetermined value and (ii) power of the combined adaptive directional signal is substantially minimized by ensuring that the derivative with respect to signal weight of the energy of the output signal is zero (Fig. 7 abstract col. 6 line 15-65) and wherein the first signal weight and the second signal weight are calculated for a series of frames each frame having a predetermined length including first signal samples and second signal samples(Fig. 7 col. 5 line 61-67 col. 6 line 1-12 line 30-34)
Furthermore Feng discloses the first and second signal can be derived from microphones of various directivity including omni-directional and bi-directional (col. 18 line 30-37).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the microphone configuration of Bradley with the adaptive summing process of Feng in order to better suppress interference in input audio signals.

.

Bradley in view of Feng does not explicitly disclose wherein the first signal weight and the second signal weight are smoothed to minimize frame-to-frame variation in the calculated weights.

Laroche discloses an audio processing system that generates channel weights and the weight are smoothed to minimize frame-to-frame variation in the calculated weights (Fig. 1 col. 4 line 65-67 col. 5 lines 1-10).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the beamformer of Bradley in view of Feng with a smoother for the weights in order to avoid erratic variations as taught by Laroch (col. 5 line 1-2).

Claim 33 analyzed with respect to claim 1, Bradley in view of Feng and Larouche disclose wherein the first signal weight and the second signal weights are calculated in time domain (Feng Fig. 7 col. 6 line 31-34 Larouche col. 4 line 65-67)

2. Claims 11, 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bradley (5463694) in view of Feng et al (7076072) in further view of Laroche (6405163) in view of Masuda et al (5384843).

Claim 11 analyzed with respect to claim 1, Bradley in view of Feng does not explicitly disclose whereby said signal weights are calculated so as to construct an omni-directional combined signal when a total power in said first signal is below a certain value.

Masuda discloses whereby said signal weights are calculated so as to construct an omni-directional combined signal when a total power in said first signal is below a certain value (Fig. 10 and col. 9 line 21-46).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the mic array of Bradley & Feng with the switch processing of Masuda in order to improve audio quality of the received signal.

Claim 27 analyzed with respect to claim 20 recite the limitations of claim 11.

3. Claims 16, 31, 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bradley (5463694) in view of Feng et al (7076072) in further view of Laroche (6405163) in further view of Warren (7471798).

Claim 16 analyzed with respect to claim 13-14, 1 Bradley in view of Feng do not explicitly disclose further comprising amplifying the signals produced by the front and/or the rear microphone before constructing the bi-directional signal, to ensure an equivalent gain between the microphones.

Warren discloses amplifying the signals produced by the front and/or the rear microphone before constructing the directional signal, to ensure an equivalent gain between the microphones (Fig. 14 and col. 11 lines 35-45).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the mic inputs of Bradley in view of Feng with the

matching of Warren in order to improve the accuracy of the beamforming process.

Claim 31 analyzed with respect to claim 20, 28 recite the limitations of claim 16.

Claim 34 analyzed with respect to claim 1, Bradley discloses wherein said one of two omni-directional microphones is a front microphone and the other one of omni-directional microphone is a rear microphone, (fig. 5).

Bradley in view of Feng and Larouche do not explicitly disclose and wherein the front and rear microphones are matched.

Warren discloses amplifying the signals produced by the front and/or the rear microphone before constructing the directional signal, to match the microphones (Fig. 14 and col. 11 lines 35-45).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the mic inputs of Bradley in view of Feng with the matching of Warren in order to improve the accuracy of the beamforming process.

4. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bradley (5463694) in view of Feng et al (7076072) Laroche (6405163) in view of Hoshuyama (5627799).

Claim 26 analyzed with respect to claim 20, Bradley in view of Feng does not disclose including a leaky integrator to perform a running sum on said first and second signal samples in order to address issues of numerical overflow system memory.

Hoshuyama discloses in the prior art a leaky integrator to perform a running sum on said samples in order to address issues of numerical overflow system memory (Fig. 3 and col. 5 lines 1-8).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to implement the beam former of Feng with the filter circuitry of Hoshuyama admitted prior art in order to have a well-known and therefore easy to implement method of filtering the signal.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to FATIMAT O. OLANIRAN whose telephone number is (571)270-3437. The examiner can normally be reached on M-F 10:00-6 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vivian Chin can be reached on 571-272-7848. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

FO

/VIVIAN CHIN/
Supervisory Patent Examiner, Art Unit 2614